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At Current Levels, Fluoride Unlikely a Limiting Factor for the Endangered Appalachian Elktoe

The Appalachian elktoe (*Alasmidonta raveneliana*), a federally-listed endangered mussel, historically occurred throughout the Cumberland and Tennessee River drainages. The mussel's range is now quite restricted, and one of the best remaining populations is in North Carolina's Nolichucky River system. The North Toe River (a tributary to the Nolichucky) receives wastes containing fluoride from mining operations. Fluoride is known to be toxic to fish, aquatic insects and some mussels, but no data were available for the Appalachian elktoe.

The U.S. Fish and Wildlife Service worked with the U.S. Environmental Protection Agency to evaluate fluoride as a possible limiting factor in recovery of this species, and a publication on the project is available:

Keller, AE and T Augspurger. 2005. Toxicity of fluoride to the endangered unionid mussel, *Alasmidonta raveneliana*, and surrogate species. *Bull Environ Contam Toxicol* 74: 242-249.

Appalachian elktoe (*Alasmidonta raveneliana*)

Among the results of that work are the following observations:

• The North Carolina water quality standard of 1.8 milligrams fluoride per liter (parts per million, or ppm) is protective against fluoride-inducted mortality of the Appalachian elktoe.

• Fluoride has been present at <0.1 to 8.0 ppm in the Nolichucky River and North Toe River over the past decade. These concentrations, while sometimes in excess of State standards, are well below those that would kill mussels. Effects on mussel reproduction are not known.

• In 9-day tests, fluoride impaired juvenile mussel growth, but the effective concentrations were about 17-times greater than the State standard. Because impacts were measurable after such a short time and mussels live for decades, it is prudent to test longer exposures at lower levels.

• The life history of the elktoe is complex and requires a fish host for larval development. The mottled sculpin (*Cottus bairdii*) was determined to be a viable host fish for the transformation of Appalachian elktoe glochidia (larvae) into juveniles. Identification of host fish species fills a need identified in the Appalachian elktoe recovery plan.

We've used sound science and cooperation to investigate water quality impacts to endangered fish and mussels in North Carolina, allowing all who care about the recovery of these species to make better informed decisions. The current paper can be obtained by contacting Tom Augspurger, U.S. Fish and Wildlife Service, at 919/856-4520 ext. 21 or tom_augspurger@fws.gov. Also, please visit our website at http://nc-es.fws.gov/ecotox/.